Amendments to the Specification (published version):

Before paragraph [0001] please insert the following:

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

After paragraph [0001] please insert the following:

2. DESCRIPTION OF THE RELATED ART

After paragraph [0008] please insert the following:

BRIEF SUMMARY OF THE INVENTION

Before paragraph [0057] please insert the following:

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Please replace paragraph [0058] of the application as published with the following:

[0058] FIG. 1 is a schematic view showing a general view of a drilling system incorporating the present invention;

Please replace paragraph [0059] of the application as published with the following:

[0059] FIGS. 2A and 2B are schematic views showing a first embodiment of a drill shaft according to the invention, having rings with links. FIG. 2A shows the first embodiment without torque; FIG. 2B shows a portion of the first embodiment under torque;

Please replace paragraph [0060] of the application as published with the following:

[0060] FIG. 3 is a schematic view showing a second embodiment of a drill shaft according to the invention, having rings with teeth;

Please replace paragraph [0061] of the application as published with the following:

[0061] FIGS. 4a1, 4a2 and 4b are schematic views showing a third embodiment of a drill shaft according to the invention, having rings with torsion rings. Figures 4a1 and 4b each show implementations of the embodiment in the unloaded position. Figure 4a2 shows a portion of the implementation of Figure 4a1 in a loaded position;

Please replace paragraph [0062] of the application as published with the following:

[0062] FIGS. 5A and 5B are schematic views showing a fourth embodiment of the invention, having rings with inclined links. Figure 5A shows the fourth embodiment in a first position. Figure 5B shows the fourth embodiment rotated 90 degrees;

Please replace paragraph [0063] of the application as published with the following:

[0063] FIGS. 6A and 6B are schematic views showing a fifth embodiment of the invention, having rings with axial and inclined links. Figure 6A shows the fifth embodiment in a first position. Figure 6B shows the fifth embodiment rotated 90 degrees;

Please replace paragraph [0064] of the application as published with the following:

[0064] FIGS. 7A and 7B are schematic views showing a modified version of the embodiment of FIG. 6, having rings with detached axial links. Figure 7A shows the modified embodiment in a first position. Figure 7B shows the modified embodiment rotated 90 degrees;

Please replace paragraph [0065] of the application as published with the following:

[0065] FIGS. 8A and 8B are schematic views showing a sixth embodiment of the invention, having rings with load supports and spring mounts. Figure 8A shows the sixth embodiment in a first position. Figure 8B shows the sixth embodiment rotated 90 degrees;

Please replace paragraph [0066] of the application as published with the following:

[0066] FIGS. 9A and 9B are schematic views showing a modified version of the embodiment of FIG. 8, having rings with load supports and buttons. Figure 9A shows the modified embodiment in a first position. Figure 9B shows the modified embodiment rotated 90 degrees;

Please replace paragraph [0067] of the application as published with the following:

[0067] FIGS. 10A and 10B are schematic views showing another modification of the embodiment of FIG. 8, having rings with load supports and tension latches. Figure 10A shows the modified embodiment in a first position. Figure 10B shows the modified embodiment rotated 90 degrees;

Please replace paragraph [0068] of the application as published with the following:

[0068] FIG. 11 is a schematic view showing an embodiment of the invention including the features shown in FIGS. 8, 9, 10;

Please replace paragraph [0069] of the application as published with the following:

[0069] FIG. 12 is a schematic view showing a seventh embodiment of the invention, having two shafts with bending cells;

Please replace paragraph [0070] of the application as published with the following:

[0070] FIGS. 13A, 13B and 13C are schematic views showing further details of one particular implementation of the seventh embodiment, having two shafts with rings with wings; and

Please replace paragraph [0071] of the application as published with the following:

[0071] FIG. 14 is a schematic view showing a drilling system incorporating the embodiments of FIGS. 12 and 13.

Before paragraph [0072] please insert the following:

DETAILED DESCRIPTION OF THE INVENTION

Please replace paragraph [0078] of the application as published with the following:

[0078] In the next proposed structure (FIGS. 4a1 and 4a2), the torque capability is improved by the use of a torsion ring 36. This torsion ring 36 is a thin disk attached to the main rings 30 by main links 38 180° apart. There is a 90° angular shift between the main links 38, 38' on both faces of the same torsion ring 36. With this structure, torque can be transmitted from successive shaft rings 30 (for example, from ring A to ring B) while at the same time being inclined thanks to the high flexibility of the torsion ring 36 in its own plane. This structure allows torque transmission under shaft bending.

Please replace paragraph [0082] of the application as published with the following:

[0082] A direct modification of this system is shown in FIGS. 5A-5B. In this structure, the successive rings 30 are held together by four inclined (tilted) links 44, adjacent links having opposite angles of inclination. When the shaft bends, successive rings 30 become non-parallel by flexing the inclined links 44. Axial loads (compression, tension) can be transmitted from ring to ring via the inclined links 44. However, the axial force in the inclined links 44 is increased (compared to the shaft axial load) due to the angle of inclination. Care must therefore be taken to avoid buckling of the links 44 under compression either due to the torque or shaft bending. This structure is flexible in all directions.

Please replace paragraph [0083] of the application as published with the following:

[0083] FIGS. 6A and 6B show an improved structure compared to FIGS. 5A and 5B. By virtue of the addition of two axial links 46 (at 180°), the strength of the structure is substantially increased for axial loads. With this embodiment, the axial links 46 bend when the shaft bends. As with the embodiments of FIGS. 2A, 2B, 3, 4A1,4A2 and 4B, the shaft can only bend by rotating around the axis passing both axial links. The shaft is therefore constructed of successive link cells rotated by 90° (as already explained for the structure of FIGS. 2A,2B & 4A1,4A2,4B above).

Please replace paragraph [0084] of the application as published with the following:

[0084] FIGS. 7A and 7B are a modification of the embodiment shown in FIGS. 6A and 6B. The axial link 48 is detached form the ring 30 at one end 50, but is separated therefrom by a very small distance. This small separation allows the link 48 to take axial load only when the system is in compression and deforms enough for the ring 30 to contact the end 50. The axial link 48 does not bend when the shaft bends. With this system, the shaft can only bend by rotating around the axis passing through both axial links 48. In drill-string applications, the compression forces are typically higher than the tension forces on the drill string so the lack of structural reinforcement by the link 48 in tension is not so significant.

Please replace paragraph [0085] of the application as published with the following:

[0085] In FIGS. 6A, 6B, 7A and 7B, the basic cell structure (two successive rings 30) has different bending stiffness at 90°. There is a rigid direction (due to the axial link 46, 48) and a soft direction at 90° thereto.

Please replace paragraph [0086] of the application as published with the following:

[0086] FIGS. 8A and 8B show another modified version of the embodiment shown in FIG. 6. In the soft plane, two removable compression load supports 52 can be positioned between the rings 30. When so positioned, these removable load supports 52 prohibit bending in the soft plane. The supports 52 are held in position by spring mountings 54 allowing the supports to be pushed out of the support position into a neutral position in which they cannot contact the rings 30. In the embodiment shown, the supports 52 can be pushed towards the centre of the shaft, but other movements are possible. With this structure, the basic cell is normally stiff in all directions, but with a minimum local intervention (i.e. by moving the supports 52 against the action of the springs 54), the rigidity in one plane can be suppressed so as to create a temporary soft plane for bending.

Please replace paragraph [0087] of the application as published with the following:

[0087] FIGS. 9A and 9B combine the concepts described in FIGS. 7A, 7B & 8A, 8B. In this case, four axial load supports 56, 56' are used. These are attached only at one end (similar to the axial links 48 of FIGS. 7A,7B) alternately to the upper and lower rings. When normally aligned, they prohibit any reduction of spacing between the rings such that the shaft is stiff in all directions. By pushing away one of these supports 56, 56', the shaft can immediately bend in that

direction. Pushing of the supports 56, 56' out of their normal positions can be achieved by use of a button 58 on the outer surface of each support. When passing through the bending guide 18 of the drilling machine 12 (see FIG. 1), the guide 18 pushes on these buttons (on the inside of curve 26) allowing the shaft to bend. As soon as the shaft in out of the bending section 18 of the drilling machine 12, the supports 56, 56' remain in their normal positions and the shaft becomes stiff again.

Please replace paragraph [0088] of the application as published with the following:

[0088] In FIGS. 10A and 10B, the embodiment of FIGS. 8A and 8B are modified by the addition of tension latch 60 on load supports 52. The latches 60 allow the supports 52 to resist both compression and tension loads. When in place, the supports 52 with the latches 60 make the shaft more resistant to bending in the "soft plane". Furthermore, the shaft can resist higher axial pull when the load supports 52 are in their normal position as they can take part of the shaft tension load.

Please replace paragraph [0088] of the application as published with the following:

[0089] FIG. 11 shows a structure which embodies features of FIGS. 8A, 8B, 9A, 8B and 10A, 10B. For ease of understanding, the shaft is shown unwrapped as it would be if constructed from one sheet of metal which is be rolled and jointed (welded). The basic structure is one of includes links 44 and axial links 46 as before. A latch 62 connected to the ring 30 by a spring mounting 64 is provided with formations which engage lock structures (described in more detail below) fixed to the adjacent rings 30 (e.g. A & B). A push button 66 is provided on the outer surface each latch 62 to operate in the manner as described above in relation to FIGS. 9A,9B, i.e.

in the normal position. the shaft is in stiff mode. operation of the button moves the latch 62 out of its normal position into a soft mode. The latch 62 includes upper and lower outer abutment surfaces a, b which are close to, but separated from, the adjacent rings (e.g. B & C). In compression, distortion of the structure causes the formations a, b to contact the rings B, C such that the latch forms an axial load support. Upper and lower tension locks 68, 70 with opposed lock structures extend from each side of a ring 30 (e.g. C & D). Each latch 62 extends between the tension locks 68, 70 and is provided with inner abutment surfaces c, d which are positioned adjacent the lock structures. In tension, adjacent rings 30 (e.g. C & D) move apart slightly due to distortion of the structure such that the inner abutment surfaces c, d engage the lock structures on the tension locks 68, 70 and the latch forms a tension load support. The exact for of structure for compression and tension support can be varied around the principles shown here. As is described above, the latch is moved to an inoperative position when pressure is applied to the button 66 such that it provided no support in either tension or compression and the shaft is placed in a soft mode.

Please replace paragraph [0090] of the application as published with the following:

[0090] FIG. 12 shows a different embodiment of the invention which uses shafts with successive cells 31 which allow bending in only one direction, but with successive angular de-phasing of the bending direction from cell to cell. In this case, two shafts 72, 74 are used. One shaft 72 has a slightly larger inner diameter than the outer diameter of the other shaft 74 such that the smaller shaft can sit inside the larger one. When so arranged, if the bending cells 31 of both shafts 72, 74 are "in phase" (the axial links 73, 75 of both shafts are aligned for each section), bending is relatively easy as both shafts allow for corresponding bending in each cell. If, on the

other hand, the shafts are out of phase by 90° rotation, bending of the drill-string assembly becomes relatively difficult, since for each cell in a shaft allowing bending, the corresponding cell of the other shaft resists bending due to its 90° de-phasing. With this technique, it is obvious that the overall shaft stiffness depends on a 90° rotation between the two shafts 72, 74. Each shaft 72, 74 can be constructed according to the principle shown in FIGS. 2-4 and described above.

Please replace paragraph [0091] of the application as published with the following:

[0091] FIGS. 13A, 13B, 13C show particular implementations of the technique generally described in FIG. 12 above. In this case, the rigidity of drill-string assembly is increased by the presence of wings 76, 78 extending outwardly from the axial links 75 of the inner shaft 74 (shown in perspective and plan view in Figure 13A), and inwardly from the axial links 73 of the outer shaft 72 respectively (shown in perspective and plan view in Figure 13B). The wings 76, 78 of one shaft extend between the rings 80, 82 of the other shaft. When the two shafts 72, 74 are out of phase by 90°, the wings 76, 78 of one shaft directly support the middle part of the rings 80, 82 of the other and prohibit any displacement of these rings (which means that the shaft cannot bend). This arrangement is shown as configuration A of FIG. 13. When the shafts are rotated by approximately 90°, the wings 76, 78 do not support the mid points of the rings 80, 82 and bending is allowed. This arrangement is shown as configuration B of FIG. 13.